Claims

1. A tuneable laser system configured to emit output radiation on a single longitudinal mode at a laser emission frequency, the laser system including
   an external cavity having a physical length L_0 and a plurality of cavity modes;
   a gain medium to emit an optical beam into the external cavity;
   a channel allocation grid element being arranged in the external cavity to define a plurality of pass bands substantially aligned with corresponding channels of a selected wavelength grid, the pass bands having a bandwidth at full-width half maximum (FWHM);
   and a tuneable element being arranged in the external cavity to tuneably select one of the pass bands so as to select a channel to which to tune the optical beam,

   wherein L_0 is not larger than 15 mm and the bandwidth at FWHM of the channel allocation grid element is comprised between 2 and 8 GHz.

2. A laser system according to claim 1, wherein the bandwidth of the channel allocation grid element at FWHM is comprised between 3 and 6 GHz.

3. A laser system according to claims 1 or 2, wherein the length L_0 is not larger than 12 mm.

4. A laser system according to any of the preceding claims, wherein the laser emission frequency is selected on a single cavity mode within a given frequency accuracy $\Delta\nu$ which is not smaller than 0.5 GHz and the bandwidth of the channel allocation grid element at FWHM is selected so that the minimum distance between two adjacent cavity modes of the external cavity within the pass bands of the channel allocation grid element, s_{min}, is not larger than twice the frequency accuracy $\Delta\nu$.

5. A laser system according to one of the preceding claims, wherein the selected wavelength grid has a channel spacing that ranges from 25 to 200 GHz.

6. A laser system according to one of the preceding claims, wherein the selected wavelength grid has a channel spacing of 25 or 50 GHz.

7. A laser system according to one of the preceding claims, wherein the channel allocation grid element comprises a Fabry-Perot etalon.

8. A laser system according to claim 7, wherein the Fabry-Perot etalon is placed at an inclination angle comprised between 0.4° and 0.8° to the perpendicular to the optical beam.

9. A laser system according to claims 7 or 8, wherein the Fabry-Perot etalon is placed at an inclination angle is of 0.5° to the perpendicular to the optical beam.

10. A laser system of one of the preceding claims, wherein the tuneable element has a bandwidth at FWHM ranging from 50 to 250 GHz.

11. A laser system of claim 10, wherein the tuneable element has a bandwidth at FWHM ranging from 50 to 100 GHz.

12. A laser system of one of the preceding claims, wherein the tuneable element comprises a tuneable mirror placed at one end of the external cavity.

13. A laser system of one of claim 12, wherein the tuneable mirror is an electro-optical element that includes a waveguide formed onto a substrate and a diffraction grating formed onto the waveguide.

14. A laser system of claim 13, wherein the tuneable mirror further comprises a cladding layer that fills at least the interstices of the diffraction grating, said cladding layer comprising a liquid crystal material.

15. A laser system of one of the preceding claims, wherein the gain medium is a semiconductor laser diode.

16. A laser system of one of the preceding claims, wherein the laser emission frequency is selected on a single transversal cavity mode.

17. A method for controlling a laser emission frequency of a tuneable laser system having an external cavity defining a plurality of cavity modes spaced from each other by $(FSR)_{cavity}$, the laser emission frequency being selected on a single longitudinal cavity mode, said method comprising the steps of

tuning an optical beam emitted from a gain medium to a corresponding centre frequency of a pass band selected from a plurality of pass bands substantially aligned with corresponding channels of a selected wavelength grid element,
selecting the bandwidth at FWHM of the selected pass band so that

$FWHM < 2.5(FSR)_{cavity}$ and

$FHWM \geq 2$ GHz.

18. A method according to claim 17, wherein the bandwidth at FWHM of the selected pass band is not larger than 8 GHz.

19. A method according to claim 18, wherein the bandwidth at FWHM of the selected pass band is comprised between 3 and 6 GHz.

20. A method according to claims 18 or 19, wherein the channels of the selected wavelength grid element have a channel spacing comprised between 25 to 100 GHz.

21. A method according to claim 20, wherein the bandwidth at FWHM of the selected pass band and s_{min} satisfy the following relationship

$FWHM = \alpha + \beta \cdot s_{min}$

where α ranges from –0.8 to –2.7 GHz and β ranges from 1.2 to 2.6.

22. A method of claim 17, further comprising the step of aligning the laser emission frequency with the selected pass band by adjusting the injection current of the gain medium so as to maximise the laser output power.

23. A method for controlling a laser emission frequency of a tuneable laser system having an external cavity defining a plurality of cavity modes spaced from each other by $(FSR)_{cavity}$, the laser emission frequency being selected on a single longitudinal cavity mode within a given frequency accuracy $\Delta\nu$, said method comprising the steps of tuning an optical beam emitted from a gain medium to a corresponding centre frequency of a pass band selected from a plurality of pass bands substantially aligned with corresponding channels of a selected wavelength grid element,
selecting the bandwidth at FWHM of the selected pass band so that it is not larger than $2.5(FSR)_{cavity}$ and so that the minimum distance between two adjacent cavity modes of the external cavity within the pass band, s_{min}, is not larger than twice the frequency accuracy $\Delta\nu$.

24. A method according to claim 23, wherein the frequency accuracy Δv is not smaller than 0.5 GHz.